Spectrum Controls 1746 I/O Module Installation Instructions

Catalog Numbers:

1746sc-INO4i/vi	**1746sc-IA8I**
1746sc-INI4i/vi	**1746sc-IB8I**
1746sc-OAP8I	**1746sc-IC8I**
1746sc-NI8u	**1746sc-IM8I**
1746sc-CTR4	**1746sc-CTR8**
1746sc-NO8i	**1746sc-NO8v**

Complete product manuals may be downloaded from our web site: www.spectrumcontrols.com

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GENERAL INFORMATION

This document is intended for experienced users. The information provided in this document will allow you to configure, wire, and install your module. Please refer to your owner's manual for more comprehensive information about your module's configuration and maintenance. You may download your manual from our website *www.spectrumcontrols.com.*

Your module is intended to only be used with Allen-Bradley SLC500 systems.

PRECAUTIONARY WARNINGS

CAUTION – ELECTROSTATICALLY SENSITIVE COMPONENTS

Before handling the module, touch a grounded object to rid yourself of electrostatic charge. When handling the module, wear an approved wrist strap-grounding device. Handle the module from the front, away from the backplane connector. Do not touch backplane connector pins. Lastly, keep the module in its static-shield container when not in use or during shipment.

This equipment is suitable for use in Class I, Division 2, Groups A, B, C, and D or non-hazardous locations only.

For UL and cUL compliance, power and input/output (I/O) wiring must be in accordance with Class I, Division 2, wiring methods [Article 501-4(b) of the National Electrical Code, NFPA 70] and the authority having jurisdiction.

CAUTION – POSSIBLE EQUIPMENT OPERATION

Before installing or removing your module, always disconnect power from the SLC 500 system and from any other source to the module (in other words, don't "hot swap" your module), and disconnect any devices wired to the module. Power, input and output (I/O) wiring must be in accordance with Class I, Division 2 wiring methods (Article 501-4(b) of the National Electrical Code, NFPA 70) and in accordance with the authority having jurisdiction

Peripheral equipment must be suitable for the location in which it is used.

WARNING – EXPLOSION HAZARD – Substitution of components may impair suitability for class I, Division 2

WARNING – EXPLOSION HAZARD – When in hazardous locations, turn off power before replacing or wiring modules.

WARNING – EXPLOSION HAZARD – Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

WARNING – This device is intendedto only be used with the Allen-Bradley SLC500 systems.

STEPS TO SUCCESS

Installation of your module requires careful attention to insure proper operation. Refer to the section for your specific module for details. The basic installation will proceed as follows…

1. Determine the backplane power requirements.
2. Set your DIP switches or shunts, if applicable.
3. Wire your module.
4. Assign your module to a slot.
5. Configure each channel.
6. Set limits, scale if applicable.
7. Monitor each channel's data.
8. Check each channel's configuration and status.

GETTING TECHNICAL ASSISTANCE

If you need technical assistance, please review the troubleshooting information in Allen-Bradley's system-level *Installation and Operation Manual* before calling your local distributor or Spectrum Controls. Except for the 8 replaceable fuses (1 for each output) on the 1746sc-OAP8I, these modules contain no user-serviceable parts, and if necessary, should be returned to Spectrum Controls for repair.

Note that your module contains electronic components, which are susceptible to damage from electrostatic discharge (ESD). An electrostatic charge can accumulate on the surface of ordinary plastic wrapping or cushioning material.

In the unlikely event that the module should need to be returned to Spectrum Controls, please ensure that the unit is enclosed in approved ESD packaging (such as static-shielding / metallized bag or black conductive container). Spectrum Controls reserves the right to void the warranty on any unit that is improperly packaged for shipment.

For further information or assistance, please contact your local distributor, or call the Spectrum Controls Repair Center at (425) 746-9481 from 8:00 A.M. to 5:00 P.M., Pacific Time.

All manuals are available in Portable Document Format (PDF) from our website, *www.spectrumcontrols.com*.

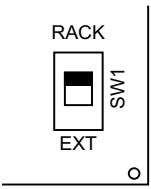
1746sc-INO4i & 1746sc-INO4vi

1. Backplane power requirements
Use the table below to calculate the total load on the system power supply. For more information, see the Allen-Bradley system Installation and Operation Manual.

		24 Vdc *	
Catalog Number	**5 Vdc**	**w/o ext. supply**	**w/ ext. supply**
1746sc-INO4i	120 mA	250 mA	0 mA
1746sc-INO4vi	120 mA	250 mA	0 mA

* The 1746sc-INO4i and 1746sc-INO4vi output modules can be connected to an external 24 Vdc power supply to reduce backplane loading.

2. Set the module's DIP switch
The switch, SW1, is located in the bottom corner of the module's large circuit board.



WARNING: Module is ESD sensitive. Handle accordingly.

NOTE: When using the External Power Feature, the external power and SLC power must be turned on simultaneously.

- With the switch in the RACK position, the module draws all its power from the backplane of the SLC system.
- With the switch in the EXT position, the module draws its 24 Vdc power from an external power source; however, the module still draws its 5 Vdc power from the backplane.

Although your module has a jumper on its printed circuit board, this jumper is for the manufacturer's use only.

3. Wire your module
To wire your module, you need:
- a small, flat-blade screwdriver
- Belden 8761 (shielded, twisted pair) cable or equivalent

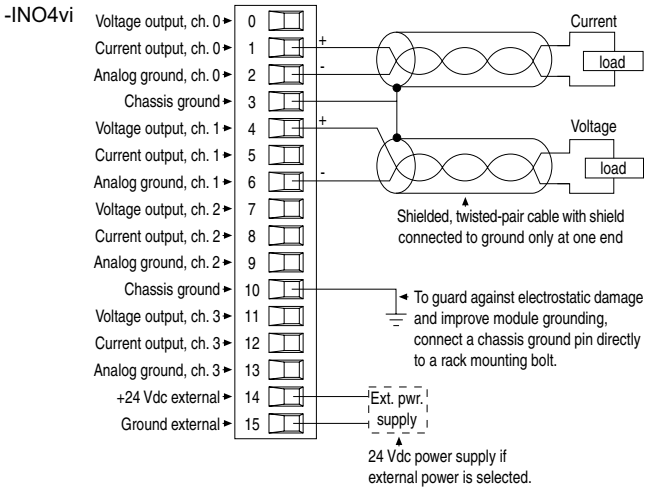
You do not need to remove the supplied 16-position terminal block from the module. If however, you do remove the terminal block, use the write-on label to identify your module's location.

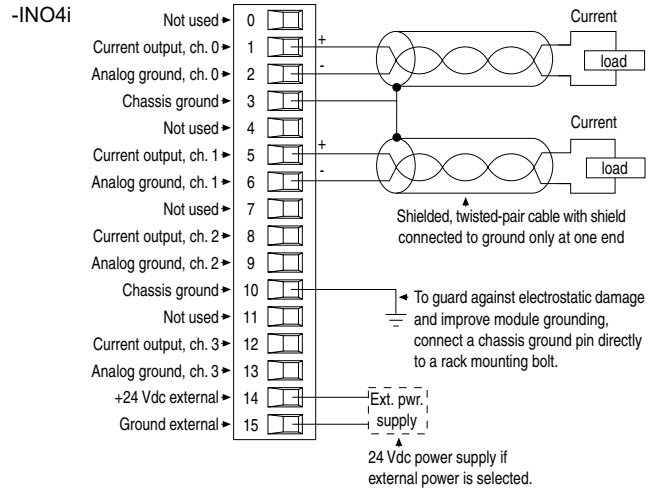
Before wiring the terminal block, turn off the power, unscrew the two retaining screws at the top and bottom of the terminal block, and carefully pry the terminal block loose.

Before removing the terminal block, take some time to plan your system:
- Ensure that the SLC 500 system is properly grounded and installed in a NEMA-rated enclosure.

- Turn off the power.
- Route the field wiring away from other wiring and as far as possible from sources of electrical noise, such as motors, transformers, contactors, and AC devices.
- Route the field wiring in grounded conduit if possible.
- Ensure that the field wiring crosses AC or power cables at a right angle.

For CE compliance, Ferrite EMI Suppressors are needed on each channel's terminal block connection. Apply the suppressor close to the module terminal block. A Steward Part 2882024-0A0 or equivalent is recommended.





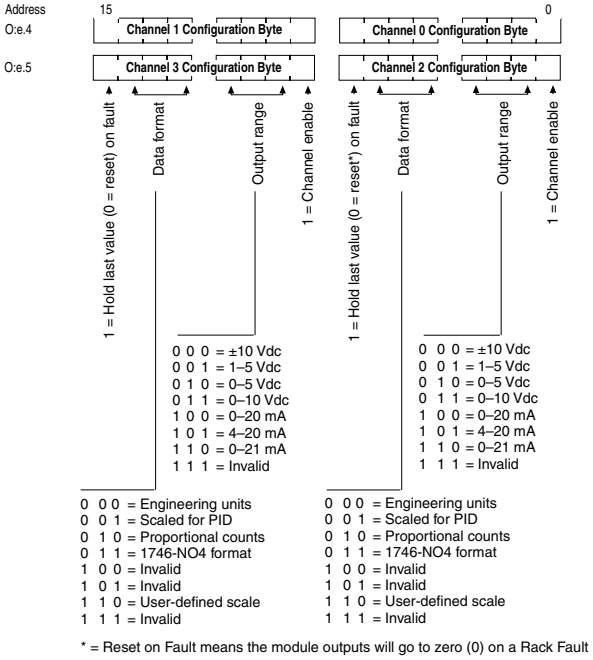
4. Assign your module to a slot

When assigning your module to a slot, select the module from the displayed list. If your module is not listed, select OTHER at the bottom of the list and enter your module's ID code at the prompt.

Catalog Number	Module ID Code
1746sc-INO4i	3521
1746sc-INO4vi	3519

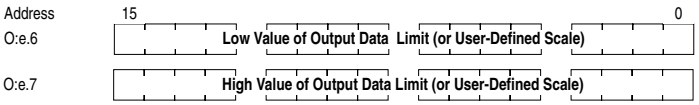
5. Configure each channel

Use the low and high bytes in Output Words 4 and 5 (addresses O:e.4 and O:e.5) to configure each channel.


Address
O:e.4
O:e.5
15
0
Channel 1 Configuration Byte
Channel 0 Configuration Byte
Channel 3 Configuration Byte
Channel 2 Configuration Byte
1 = Hold last value (0 = reset) on fault
Data format
Output range
1 = Channel enable
1 = Hold last value (0 = reset*) on fault
Data format
Output range
1 = Channel enable
0 0 0 = ±10 Vdc
0 0 1 = 1–5 Vdc
0 1 0 = 0–5 Vdc
0 1 1 = 0–10 Vdc
1 0 0 = 0–20 mA
1 0 1 = 4–20 mA
1 1 0 = 0–21 mA
1 1 1 = Invalid
0 0 0 = ±10 Vdc
0 0 1 = 1–5 Vdc
0 1 0 = 0–5 Vdc
0 1 1 = 0–10 Vdc
1 0 0 = 0–20 mA
1 0 1 = 4–20 mA
1 1 0 = 0–21 mA
1 1 1 = Invalid
0 0 0 = Engineering units
0 0 1 = Scaled for PID
0 1 0 = Proportional counts
0 1 1 = 1746-NO4 format
1 0 0 = Invalid
1 0 1 = Invalid
1 1 0 = User-defined scale
1 1 1 = Invalid
0 0 0 = Engineering units
0 0 1 = Scaled for PID
0 1 0 = Proportional counts
0 1 1 = 1746-NO4 format
1 0 0 = Invalid
1 0 1 = Invalid
1 1 0 = User-defined scale
1 1 1 = Invalid
* = Reset on Fault means the module outputs will go to zero (0) on a Rack Fault

6. Set output limits / user-defined scale (optional).

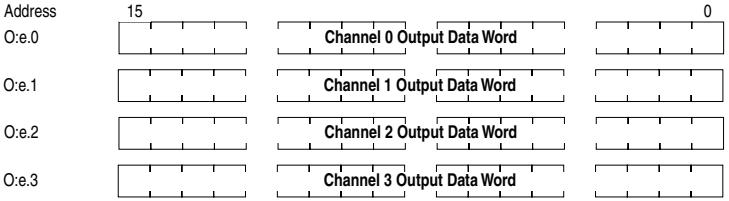
Use Output Words 6 and 7 (addresses O:e.6 and O:e.7) to set the low and high values of the output data limits or user-defined scale (if user-defined scaling is desired). If you do not want to use these features, set output words 6 and 7 to 0. Setting output words 6 and 7 to 0 disables limiting and invalidates scaling.



You cannot use output data limiting with user-defined scaling.

Important – The values in output words 6 and 7 apply to all 4 channels. If you want to use user-defined scaling or output data limiting, you must set all 4 channels to the same data format.

7. Control each channel's signal level
Use Output Words 0-3 (address O:e.0 – O:e.3) to control the output signal level of each channel. The output signal level depends on the data format and output range selected.



The following equations show you how to convert between data value (counts) and signal level (in mA or V):

$S = \{(D - D_{low}) \times (\Delta S) \div (\Delta D)\} + S_{low}$

$D = \{(S - S_{low}) \times (\Delta D) \div (\Delta S)\} + D_{low}$

where S = signal level in mA or V)

S_{low} = minimum signal level (see Table 11 in Chapter 4)

S_{high} = maximum signal level (see Table 11 in Chapter 4)

ΔS = $S_{high} - S_{low}$

D = data value (counts)

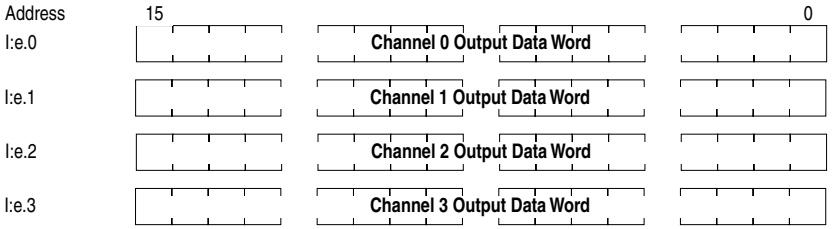
D_{low} = minimum data value (see Table 11 in Chapter 4)

D_{high} = maximum data value (see Table 11 in Chapter 4)

ΔD = $D_{high} - D_{low}$

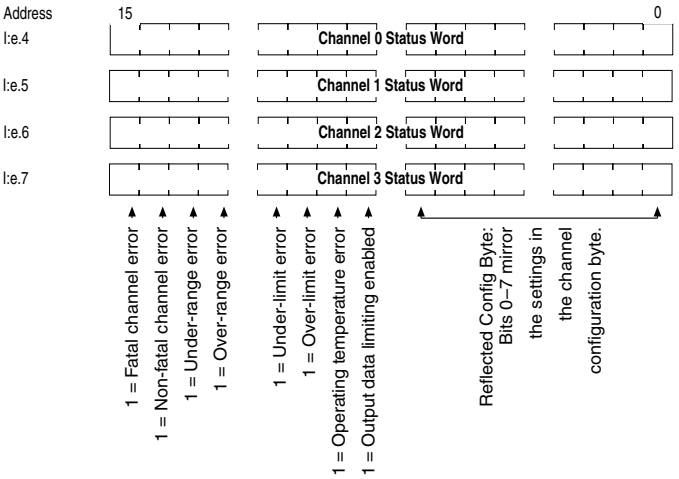
8. Monitor each channel's data

Use Input Words 0-3 (addresses I:e.0 – I:e.3) to monitor the data received by your module from the processor. When a channel is disabled, its data word is set to 0.



9. Check each channel's configuration and status

Use Input Words 4-7 (addresses I:e.4 – I:e.7) to check the configuration and status of each channel. When a channel is disabled, its status word is set to 0.



1746sc-INI4i & 1746sc-INI4vi

1. Determine the backplane power requirements.
Use the table below to calculate the total load on the system power supply. For more information, see the Allen-Bradley system Installation and Operation Manual.

	Backplane Current Consumed	
Catalog Number	**5 Vdc**	**24 Vdc**
1746sc-INI4i	460 mA typical	0 mA
1746sc-INI4vi	570 mA typical	0 mA

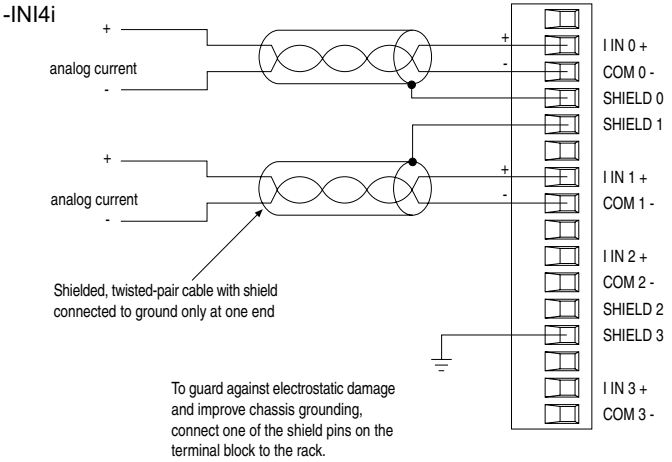
2. Wire your module.
To wire your module, you need:
- a small, flat-blade screwdriver
- Belden 8761 (shielded, twisted pair) cable or equivalent

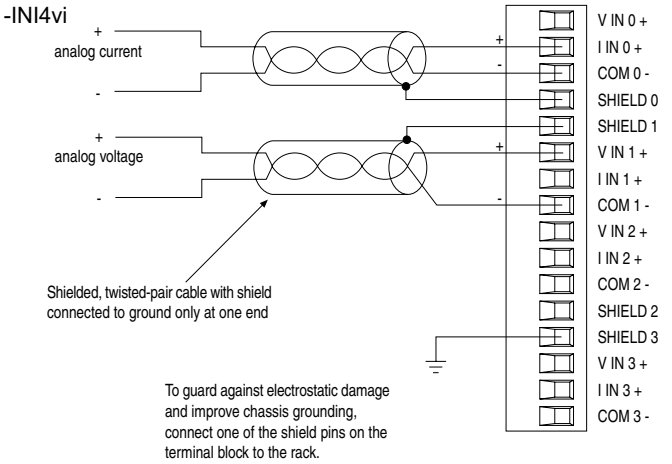
You do not need to remove the supplied 16-position terminal block from the module. If however, you do remove the terminal block, apply the supplied write-on label to the terminal block, and use the write-on label to identify your module's location.

Before wiring the terminal block, unscrew the two retaining screws at the top and bottom of the terminal block, and carefully pry the terminal block loose.

Before wiring the terminal block, take some time to plan your system:
- Ensure that the SLC 500 system is properly grounded and installed in a NEMA-rated enclosure.
- Ensure that the load resistance is <500ΩW for a current output channel and > 1 kΩW for a voltage output channel.
- Route the field wiring away from other wiring and as far as possible from sources of electrical noise, such as motors, transformers, contactors, and AC devices.
- Route the field wiring in grounded conduit if possible.
- Ensure that the field wiring crosses AC or power cables at a right angle.

For CE compliance, Ferrite EMI Suppressors are needed on each channel's terminal block connection. Apply the suppressor close to the module terminal block. A Steward Part 2882024-0A0 or equivalent is recommended.





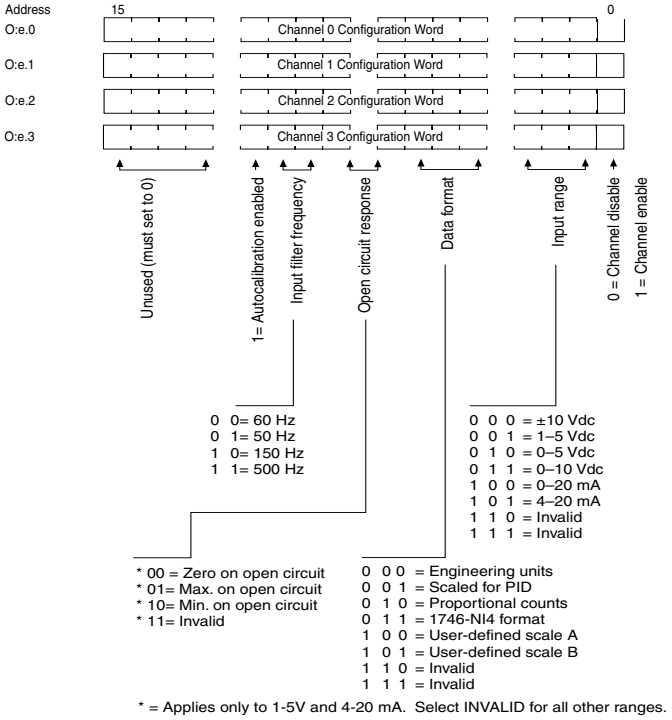
3. Assign your module to a slot.

When assigning your module to a slot, select the module from the displayed list. If your module is not listed, select OTHER at the bottom of the list and enter your module's ID code at the prompt.

Catalog Number	Module ID Code
1746sc-INI4i	3522
1746sc-INI4vi	3520

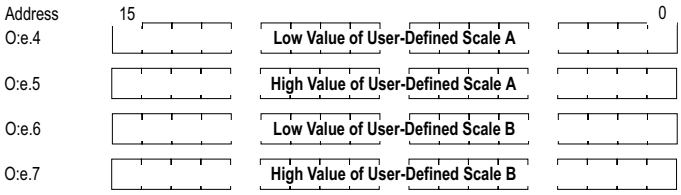
4. Configure each channel

Use the low and high bytes in Configuration Words 0-3 (addresses O:e.0 – O:e.3) to configure each channel.


Address
15
0
O:e.0
O:e.1
O:e.2
O:e.3
Channel 0 Configuration Word
Channel 1 Configuration Word
Channel 2 Configuration Word
Channel 3 Configuration Word
Unused (must set to 0)
1= Autocalibration enabled
Input filter frequency
Open circuit response
Data format
Input range
0 = Channel disable
1 = Channel enable
0 0= 60 Hz
0 1= 50 Hz
1 0= 150 Hz
1 1= 500 Hz
0 0 0 = ±10 Vdc
0 0 1 = 1–5 Vdc
0 1 0 = 0–5 Vdc
0 1 1 = 0–10 Vdc
1 0 0 = 0–20 mA
1 0 1 = 4–20 mA
1 1 0 = Invalid
1 1 1 = Invalid
* 00 = Zero on open circuit
* 01= Max. on open circuit
* 10= Min. on open circuit
* 11= Invalid
0 0 0 = Engineering units
0 0 1 = Scaled for PID
0 1 0 = Proportional counts
0 1 1 = 1746-NI4 format
1 0 0 = User-defined scale A
1 0 1 = User-defined scale B
1 1 0 = Invalid
1 1 1 = Invalid
* = Applies only to 1-5V and 4-20 mA. Select INVALID for all other ranges.

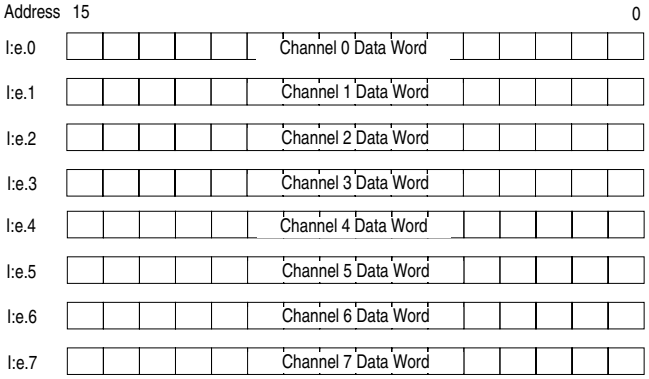
5. Set limits, scale if applicable.

Use Configuration Words 4-7 (addresses O:e.4 – O:e.7) to set the low and high values of the user-defined scale (if user-defined scaling is desired). If you do not want to use these features, set output words 4-7 to 0. Setting output words 4-7 to 0 disables scaling.



6. Monitor each channel's data

Use Input Words 0-3 (addresses I:e.0 – I:e.3) to monitor the data received by your module from the input device. When a channel is disabled, its data word is set to 0.



The following equations show you how to convert between data value (counts) and signal level (in mA or V):

$$S = \{(D - D_{low}) \times (\Delta S) \div (\Delta D)\} + S_{low}$$

$$D = \{(S - S_{low}) \times (\Delta D) \div (\Delta S)\} + D_{low}$$

where S = signal level in mA or V)

S_{low} = minimum signal level (see Table 11 in Chapter 4)

S_{high} = maximum signal level (see Table 11 in Chapter 4)

$\Delta S = S_{high} - S_{low}$

D = data value (counts)

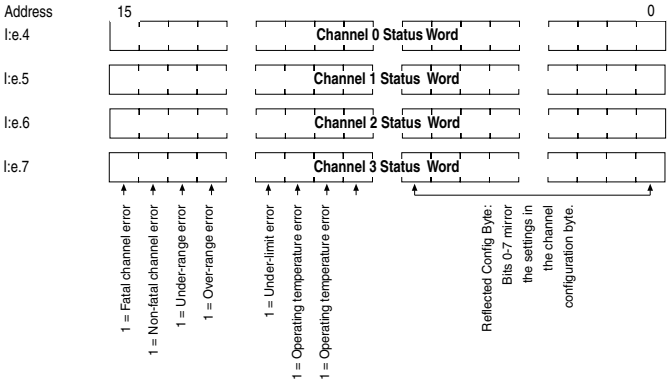
D_{low} = minimum data value (see Table 11 in Chapter 4)

D_{high} = maximum data value (see Table 11 in Chapter 4)

$\Delta D = D_{high} - D_{low}$

7. Check each channel's configuration and status

Use Input Words 4-7 (addresses I:e.4 – I:e.7) to check the configuration and status of each channel. When a channel is disabled, its status word will be set to 0.



1746sc-IA8I & 1746sc-IB8I & 1746sc-IC8I & IM8I

1. Determine the backplane power requirements.
Use the table below to calculate the total load on the system power supply. For more information, see the Allen-Bradley system Installation and Operation Manual.

	Backplane Power	
	5Vdc	24Vdc
All Modules	110mA	0mA

2. Wire your module.
To wire field devices to your module, follow these steps:
1. Turn off power to the I/O chassis.
2. **Optional**: Remove the supplied 18-position terminal block from the module. To remove the terminal block, unscrew the two retaining screws at the top and bottom of the terminal block, and pull the terminal block loose.
3. Wire field devices to your module as shown in the following wiring diagrams, using a maximum wire size of 14 AWG and a maximum of two wires per terminal. The recommended terminal screw torque is 7 to 9 in.-lb.
4. Install a wire tie in the slot below the terminal block and secure the wires.

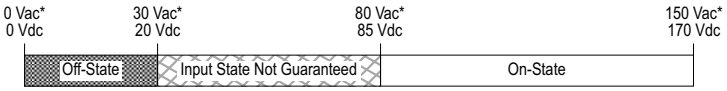
CE Compliance Requirements
For installations requiring CE compliance, you must do the following:
- Observe the grounding guidelines provided in Allen-Bradley's *SLC 500 Installation and Operation Manual* (Allen-Bradley publication 1747-NI002).
- Connect an E-GND terminal on the module directly to a rack-mounting bolt.
- Hard wire or permanently connect the PLC to the AC mains, or provide a pin and sleeve (IEC 309) connector for connection to the AC mains.

This equipment is intended for use in over-voltage category II installations (see IEC 364-4-443), where the rated mains supply voltage does not exceed 1000 Vac (50/60 Hz) or 1500 Vdc. If the input power is rated above these levels, ensure that your system is isolated from the power main by an isolation transformer (or equivalent over-voltage protection device) that has CE approval or approval from a European test agency.

For the 1746c-IA8I, -IM8I, and -OAP8I, you must also protect against electrical shock by installing the I/O chassis in an enclosure with an IP20 to IP29 rating per IEC 529. The enclosure should have warning labels (hazard symbol 417-IEC-5036) and/or a mechanical disconnect to minimize the risk of accidental shock during maintenance. Use an enclosure that can only be opened with a key or tool.

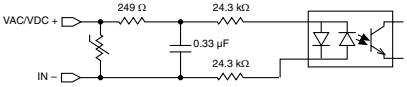
For CE compliance, Ferrite EMI Suppressors are needed on each channel's terminal block connection. Apply the suppressor close to the module terminal block. A Steward Part 2882024-0A0 or equivalent is recommended.

1746sc-IA8I On/Off-State Voltage Range

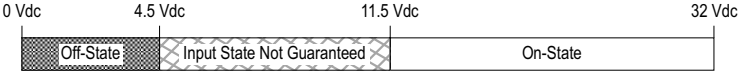


* Frequency = 47 to 63 Hz

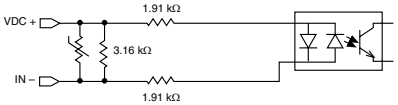
1746sc-IA8I Simplified Circuit Diagram (one circuit shown)



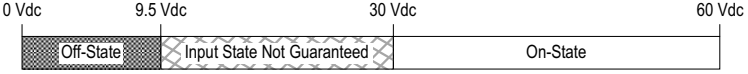
1746sc-IB8I On/Off-State Voltage Range



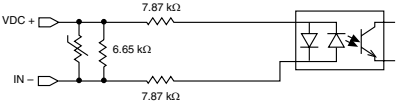
1746sc-IB8I Simplified Circuit Diagram (one circuit shown)



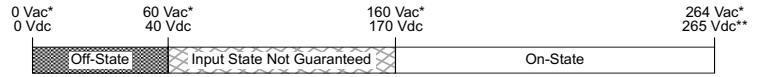
1746sc-IC8I On/Off-State Voltage Range



1746sc-IC8I Simplified Circuit Diagram (one circuit shown)



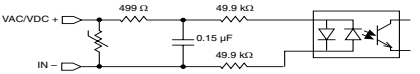
1746sc-IM8I On-Off-State Voltage Range



* Frequency = 47 to 63 Hz

** 276 Vdc short-term overload (1 hour)

1746sc-IM8I Simplified Circuit Diagram (one circuit shown)

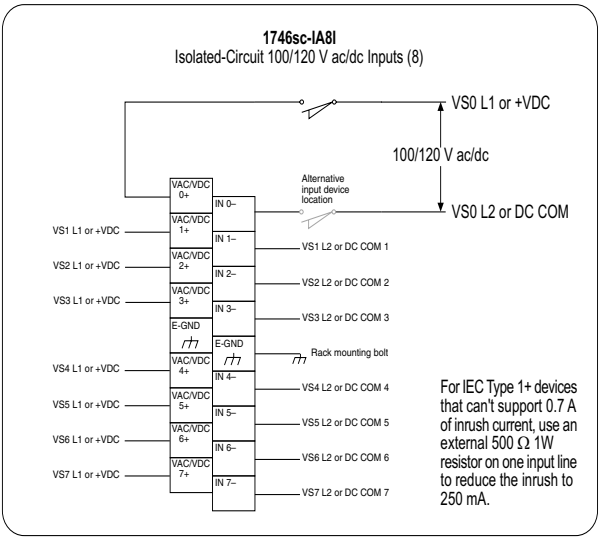


3. Assign your module to a slot.

When assigning your module to a slot, select the module from the displayed list. If your module is not listed, select OTHER at the bottom of the list and enter your module's ID code at the prompt.

Catalog Number	Module ID
1746sc-IA8I	303
1746sc-IB8I	324
1746sc-IC8I	324
1746sc-IM8I	304

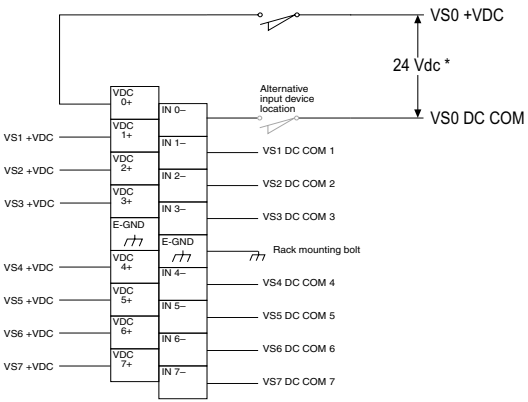
4. Configure each channel


1746sc-IA8I
Isolated-Circuit 100/120 V ac/dc Inputs (8)
VS0 L1 or +VDC
100/120 V ac/dc
Alternative input device location
VS0 L2 or DC COM
VAC/VDC 0+
IN 0–
VAC/VDC 1+
IN 1–
VAC/VDC 2+
IN 2–
VAC/VDC 3+
IN 3–
E-GND
E-GND
VAC/VDC 4+
IN 4–
VAC/VDC 5+
IN 5–
VAC/VDC 6+
IN 6–
VAC/VDC 7+
IN 7–
VS1 L1 or +VDC
VS2 L1 or +VDC
VS3 L1 or +VDC
VS4 L1 or +VDC
VS5 L1 or +VDC
VS6 L1 or +VDC
VS7 L1 or +VDC
VS1 L2 or DC COM 1
VS2 L2 or DC COM 2
VS3 L2 or DC COM 3
Rack mounting bolt
VS4 L2 or DC COM 4
VS5 L2 or DC COM 5
VS6 L2 or DC COM 6
VS7 L2 or DC COM 7
For IEC Type 1+ devices that can't support 0.7 A of inrush current, use an external 500 Ω 1W resistor on one input line to reduce the inrush to 250 mA.

Note — The input circuits are electrically isolated from each other (the commons are NOT connected internally). Therefore, up to eight different voltage sources (VS0–VS7) may be used.

Module ID Code = 303

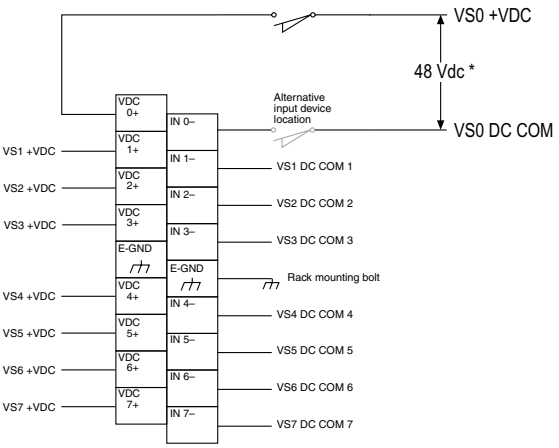
1746sc-IB8I
Isolated-Circuit 24 Vdc Inputs (8)



Note — The input circuits are electrically isolated from each other (the commons are NOT connected internally). Therefore, up to eight different voltage sources (VS0–VS7) may be used.

Module ID Code = 324

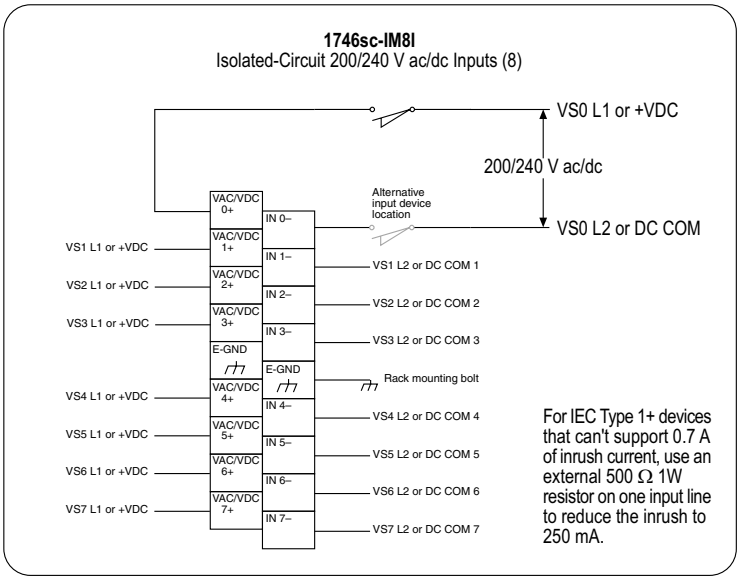
1746sc-IC8I
Isolated-Circuit 48 Vdc Inputs (8)



Note — The input circuits are electrically isolated from each other (the commons are NOT connected internally). Therefore, up to eight different voltage sources (VS0–VS7) may be used.

* Inputs are bipolar and may be connected without regard to polarity.

Module ID Code = 324

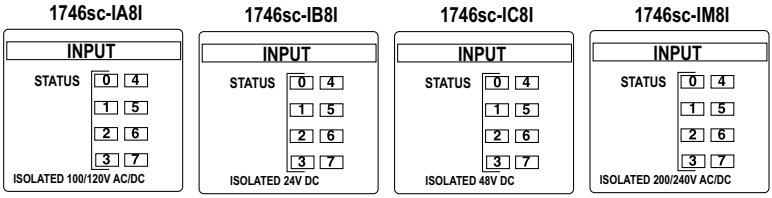

1746sc-IM8I
Isolated-Circuit 200/240 V ac/dc Inputs (8)
VS0 L1 or +VDC
200/240 V ac/dc
VS0 L2 or DC COM
Alternative input device location
VAC/VDC 0+
IN 0–
VAC/VDC 1+
IN 1–
VAC/VDC 2+
IN 2–
VAC/VDC 3+
IN 3–
E-GND
E-GND
VAC/VDC 4+
IN 4–
VAC/VDC 5+
IN 5–
VAC/VDC 6+
IN 6–
VAC/VDC 7+
IN 7–
VS1 L1 or +VDC
VS2 L1 or +VDC
VS3 L1 or +VDC
VS4 L1 or +VDC
VS5 L1 or +VDC
VS6 L1 or +VDC
VS7 L1 or +VDC
VS1 L2 or DC COM 1
VS2 L2 or DC COM 2
VS3 L2 or DC COM 3
Rack mounting bolt
VS4 L2 or DC COM 4
VS5 L2 or DC COM 5
VS6 L2 or DC COM 6
VS7 L2 or DC COM 7
For IEC Type 1+ devices that can't support 0.7 A of inrush current, use an external 500 Ω 1W resistor on one input line to reduce the inrush to 250 mA.

Note — The input circuits are electrically isolated from each other (the commons are NOT connected internally). Therefore, up to eight different voltage sources (VS0–VS7) may be used.

Module ID Code = 304

5. Interpreting your Module's LED Indicators

On the 1746sc-IA8I, -IB8I, -IC8I, and –IM8I, each status indicator (0-7) illuminates when the proper signal is received at the corresponding input terminal.



1746sc-OAP8I

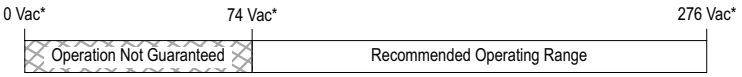
1. Determine the backplane power requirements.
Use the table below to calculate the total load on the system power supply. For more information, see the Allen-Bradley system Installation and Operation Manual.

	Backplane Power	
	5Vdc	24Vdc
All Modules	110mA	0mA

2. Set your DIP Switches or shunts, if applicable.
Not applicable.

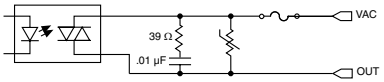
3. Wire your module.
For CE compliance, EMI Suppressors are needed on each channel's terminal block connection. Apply the suppressor close to the module terminal block. A Steward Part 2882024-0A0 or equivalent is recommended.

1746sc-OAP8I Operating Voltage Range



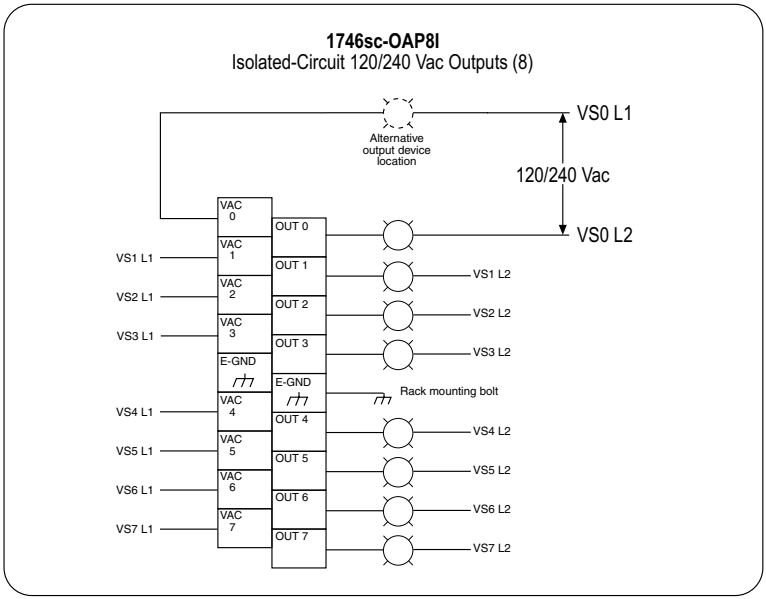
* Frequency = 47 to 63 Hz

1746sc-OAP8I Simplified Circuit Diagram (one circuit shown)



4. Assign your module to a slot.
When assigning your module to a slot, select the module from the displayed list. If your module is not listed, select OTHER at the bottom of the list and enter your module's ID code at the prompt.

Catalog Number	Module ID
1746sc-OAP8I	1905

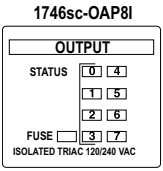


Note — The output circuits are electrically isolated from each other (the commons are NOT connected internally). Therefore, up to eight different voltage sources (VS0–VS7) may be used.

Module ID Code = 1905

5. Interpreting your Module's LED Indicators

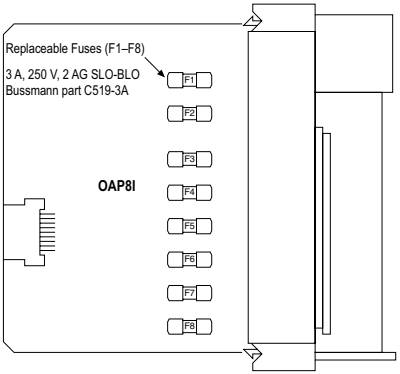
On the 1746sc-OAP8I, each status indicator (0-7) illuminates when the processor commands the module to turn on the corresponding output. The indicators do not necessarily indicate the presence or absence of AC power at an output. The Blown-Fuse indicator illuminates when any 1 of the 8 outputs fuses blows and AC power is present.



6. Checking for Blown Fuses
If a fuse blows on the 1746sc-OAP8I, the following occurs:

1. The blown-fuse LED indicator illuminates (provided your module is receiving power from the chassis).
2. The module indicates to the logic controller's input image table which fuse has blown. This allows for fuse monitoring and smart power-down sequencing of equipment after a circuit failure.

You can verify that a fuse has opened by visually checking the fuses, shown below. Turn all power off, and replace blown fuses with the specified replacement part only. Substitutes are not acceptable.



1746sc-NI8u

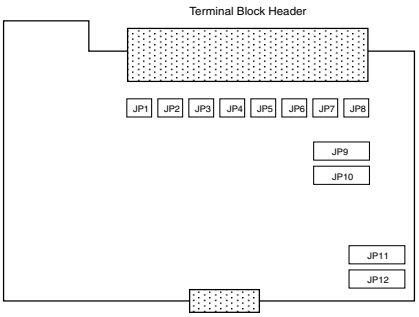
1. Determine the backplane power requirements.
Use the table below to calculate the total load on the system power supply. For more information, see the Allen-Bradley system Installation and Operation Manual.

	Backplane Current Consumed	
	5VDC	24VDC
NI8U	120mA	100mA

2. Set your DIP switches or shunts, if applicable.
The 1746sc-NI8u module is a multi-purpose, multi-functional module, which is capable of supporting many different input types in a very small package. There are a few shunts on the board that allow the user to define input paths properly, which are imperative for the configuration control to allow proper utilization of the module. JP1 through JP8 supports the current input mode options for each of the input channels, 0 through 7, respectively. In order to define channels 4 through 7 for voltage or RTD inputs, JP9 and JP10, must be configured properly. JP11 is used at the factory and should not be modified. JP12 indicates whether or not RTDs are to be used in the configuration. The module is shipped with all current input shunts in place, and the remaining shunts installed for non-RTD inputs. The shunts are to be modified prior to installation of the module. Proper precautions for electrostatic handling should be followed. Small needlenose pliers may be used to configure the shunts, if needed.

The following diagram shows the module outline defining the location of the various shunts, looking at the primary side of the board, with the terminal block pointing up. A brief description of each follows:

Terminal Block Header



JP1, JP2, JP3, JP4, JP5, JP6, JP7 and JP8 Setup

There are eight shunts corresponding to eight inputs, respectively, that exist to support the 0 to 20mA or 4 to 20mA current input selections. Each channel has an individual shunt (JP1- Ch. 0, JP2 - Ch. 2 through JP8 - Ch. 7). These shunts are two pin headers that only need to be connected if a channel is to be configured for current input. If the channel is to be used for any other type (thermocouple, millivolt, voltage for channels 0 through 3, or thermocouple, millivolt, voltage, RTD, or resistance for channels 4 through 7), then the pins are to be left open and unconnected.

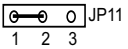
Current Input

Shunt in place

Non-Current Input

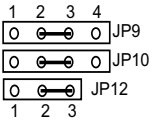
Shunt removed

JP11 Setup Located in the bottom right hand corner, JP11 should always have pins 1 and 2 connected as shown. This shunt is used during manufacturing of the module, and should never be moved by the user.

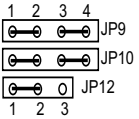


JP9, JP10, and JP12 Setup
The NI8u module supports up to four RTDs on channels 4 through 7. In order to properly support RTD or resistance inputs, JP9, JP10, and JP12 have to be configured correctly. The function of JP9 and JP10 is to define the input path for the channels 4 through 7. JP9 and JP10 are four pin headers toward the right side of the board, looking at the primary side of the board with the terminal block pointing up. JP12 is a three pin header on the very bottom right hand corner, below JP11.

Setting For RTD or Resistance Inputs
The module will either support zero RTD or resistance inputs or four RTD or resistance inputs in channels 4 through 7. To properly configure JP9 and JP10 for RTDs, set the shunts across pins 2 and 3 of the four pin headers. JP12 also needs to have pins 2 and 3 connected when RTDs or resistance inputs are to be used, as shown below.



Setting For Non-RTD or Resistance Inputs
If RTDs are not to be used, and channels 4 through 7 are to be defined as thermocouple inputs, current inputs, millivolt or voltage inputs, jumper pins 1 and 2 together, jumper pins 3 and 4 together, of JP9 and JP10, as defined below. JP12 also needs to have pins 1 and 2 connected when RTDs are not in use.



3. Wire your module.
To wire your module, you need:
- a small, flat-blade screwdriver
- Belden 8761 (shielded, twisted pair) cable or equivalent

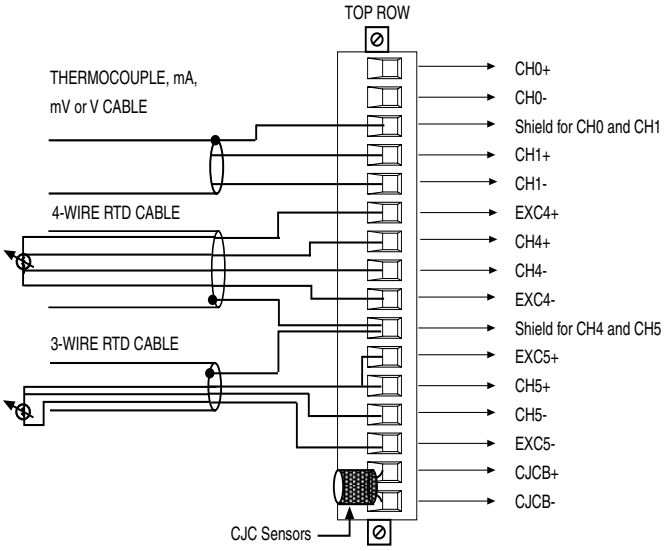
You do not need to remove the supplied 16-position terminal block from the module. If however, you do remove the terminal block, apply the supplied write-on label to the terminal block, and use the write-on label to identify your module's location.

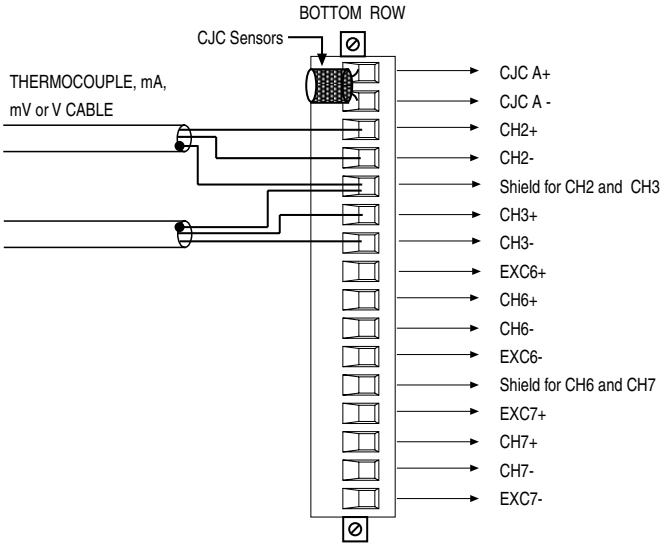
Before wiring the terminal block, unscrew the two retaining screws at the top and bottom of the terminal block, and carefully pry the terminal block loose.

Before wiring the terminal block, take some time to plan your system:

- Ensure that the SLC 500 system is properly grounded and installed in a NEMA-rated enclosure.
- Ensure that the load resistance is <500 Ω for a current output channel and > 1 kΩ for a voltage output channel.
- Route the field wiring away from other wiring and as far as possible from sources of electrical noise, such as motors, transformers, contactors, and AC devices.
- Route the field wiring in grounded conduit if possible.
- Ensure that the field wiring crosses AC or power cables at a right angle.

For CE compliance, Ferrite EMI Suppressors are needed on each channel's terminal block connection. Apply the suppressor close to the module terminal block. A Steward Part 2882024-0A0 or equivalent is recommended.





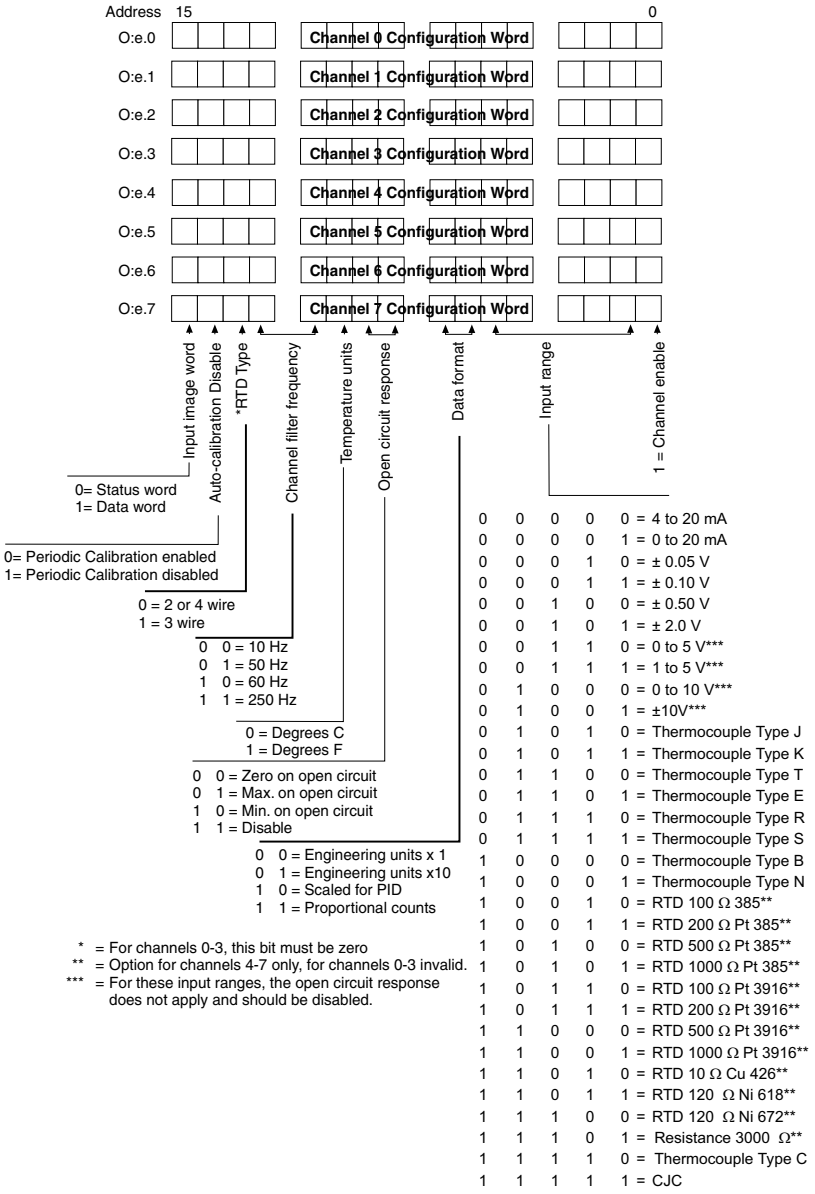
4. Assign your module to a slot.

When assigning your module to a slot, select the module from the displayed list. If your module is not listed, select OTHER at the bottom of the list and enter your module's ID code at the prompt.

Catalog Number	Module ID Code
1746sc-NI8u	3500

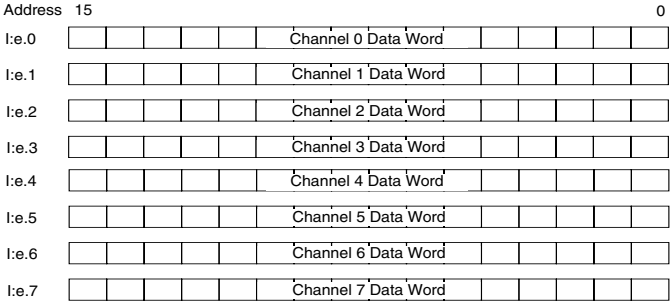
5. Configure each channel

Use the low and high bytes in Configuration Words 0-7 (addresses O:e.0 – O:e.7) to configure each channel.


Address 15 0
O:e.0 Channel 0 Configuration Word
O:e.1 Channel 1 Configuration Word
O:e.2 Channel 2 Configuration Word
O:e.3 Channel 3 Configuration Word
O:e.4 Channel 4 Configuration Word
O:e.5 Channel 5 Configuration Word
O:e.6 Channel 6 Configuration Word
O:e.7 Channel 7 Configuration Word
Input image word
Auto-calibration Disable
*RTD Type
Channel filter frequency
Temperature units
Open circuit response
Data format
Input range
1 = Channel enable
0= Status word
1= Data word
0= Periodic Calibration enabled
1= Periodic Calibration disabled
0 = 2 or 4 wire
1 = 3 wire
0 0 = 10 Hz
0 1 = 50 Hz
1 0 = 60 Hz
1 1 = 250 Hz
0 = Degrees C
1 = Degrees F
0 0 = Zero on open circuit
0 1 = Max. on open circuit
1 0 = Min. on open circuit
1 1 = Disable
0 0 = Engineering units x 1
0 1 = Engineering units x10
1 0 = Scaled for PID
1 1 = Proportional counts
0 0 0 0 0 = 4 to 20 mA
0 0 0 0 1 = 0 to 20 mA
0 0 0 1 0 = ± 0.05 V
0 0 0 1 1 = ± 0.10 V
0 0 1 0 0 = ± 0.50 V
0 0 1 0 1 = ± 2.0 V
0 0 1 1 0 = 0 to 5 V***
0 0 1 1 1 = 1 to 5 V***
0 1 0 0 0 = 0 to 10 V***
0 1 0 0 1 = ±10V***
0 1 0 1 0 = Thermocouple Type J
0 1 0 1 1 = Thermocouple Type K
0 1 1 0 0 = Thermocouple Type T
0 1 1 0 1 = Thermocouple Type E
0 1 1 1 0 = Thermocouple Type R
0 1 1 1 1 = Thermocouple Type S
1 0 0 0 0 = Thermocouple Type B
1 0 0 0 1 = Thermocouple Type N
1 0 0 1 0 = RTD 100 Ω 385**
1 0 0 1 1 = RTD 200 Ω Pt 385**
1 0 1 0 0 = RTD 500 Ω Pt 385**
1 0 1 0 1 = RTD 1000 Ω Pt 385**
1 0 1 1 0 = RTD 100 Ω Pt 3916**
1 0 1 1 1 = RTD 200 Ω Pt 3916**
1 1 0 0 0 = RTD 500 Ω Pt 3916**
1 1 0 0 1 = RTD 1000 Ω Pt 3916**
1 1 0 1 0 = RTD 10 Ω Cu 426**
1 1 0 1 1 = RTD 120 Ω Ni 618**
1 1 1 0 0 = RTD 120 Ω Ni 672**
1 1 1 0 1 = Resistance 3000 Ω**
1 1 1 1 0 = Thermocouple Type C
1 1 1 1 1 = CJC
* = For channels 0-3, this bit must be zero
** = Option for channels 4-7 only, for channels 0-3 invalid.
*** = For these input ranges, the open circuit response does not apply and should be disabled.

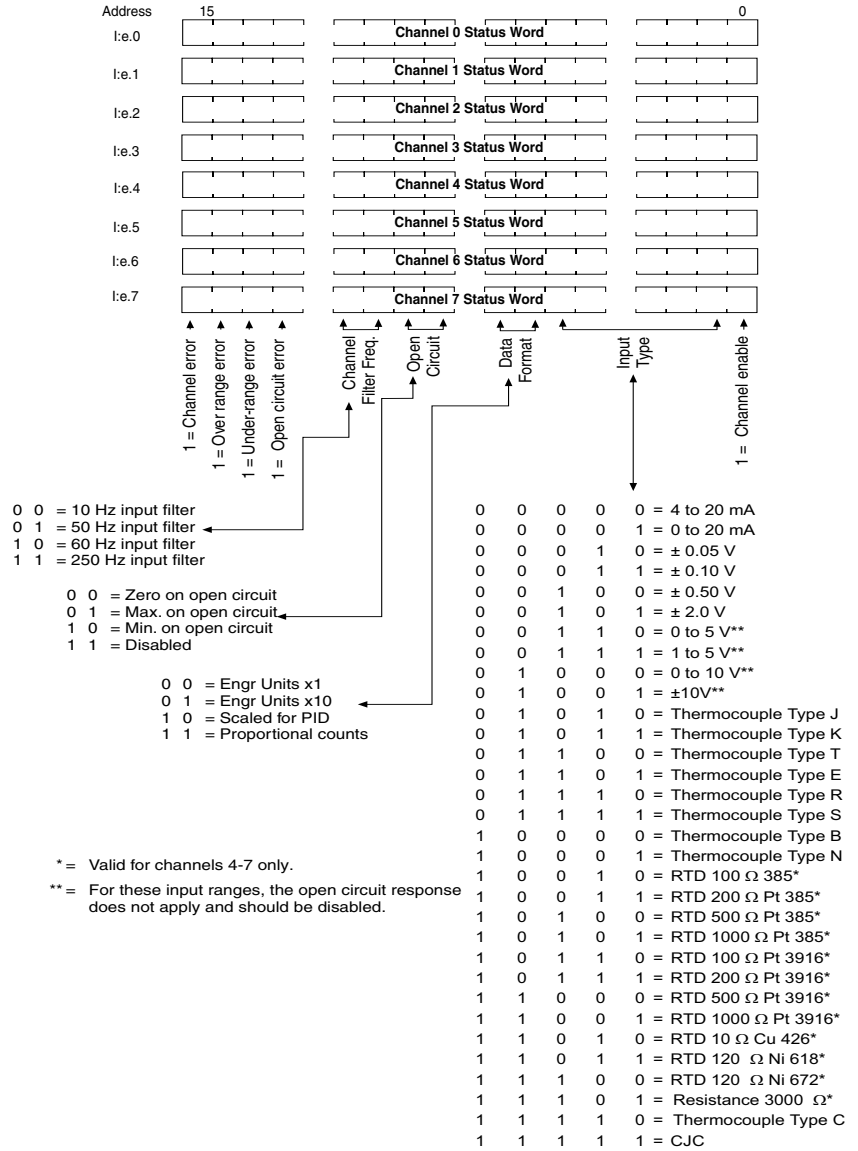
6. Monitor each channel's data

Use Input Words 0-7 (addresses I:e.0 – I:e.7) to monitor the data received by your module from the processor. When a channel is disabled, its data word is set to 0. **To receive a channel (data word) bit 15 of the channel's configuration word must be set to 1.**



7. Check each channel's configuration and status.

Use Input Words 0-7 (addresses I:e.0 – I:e.7) to check the configuration of each channel. When a channel is disabled, its status word will be set to 0. **To receive a channel status word, bit 15 of the channel's configuration word must be set to 0.**


Address
15
0
I:e.0
I:e.1
I:e.2
I:e.3
I:e.4
I:e.5
I:e.6
I:e.7
Channel 0 Status Word
Channel 1 Status Word
Channel 2 Status Word
Channel 3 Status Word
Channel 4 Status Word
Channel 5 Status Word
Channel 6 Status Word
Channel 7 Status Word
1 = Channel error
1 = Over range error
1 = Under-range error
1 = Open circuit error
Channel Filter Freq.
Open Circuit
Data Format
Input Type
1 = Channel enable
0 0 = 10 Hz input filter
0 1 = 50 Hz input filter
1 0 = 60 Hz input filter
1 1 = 250 Hz input filter
0 0 = Zero on open circuit
0 1 = Max. on open circuit
1 0 = Min. on open circuit
1 1 = Disabled
0 0 = Engr Units x1
0 1 = Engr Units x10
1 0 = Scaled for PID
1 1 = Proportional counts
0 0 0 0 0 = 4 to 20 mA
0 0 0 0 1 = 0 to 20 mA
0 0 0 1 0 = ± 0.05 V
0 0 0 1 1 = ± 0.10 V
0 0 1 0 0 = ± 0.50 V
0 0 1 0 1 = ± 2.0 V
0 0 1 1 0 = 0 to 5 V**
0 0 1 1 1 = 1 to 5 V**
0 1 0 0 0 = 0 to 10 V**
0 1 0 0 1 = ±10V**
0 1 0 1 0 = Thermocouple Type J
0 1 0 1 1 = Thermocouple Type K
0 1 1 0 0 = Thermocouple Type T
0 1 1 0 1 = Thermocouple Type E
0 1 1 1 0 = Thermocouple Type R
0 1 1 1 1 = Thermocouple Type S
1 0 0 0 0 = Thermocouple Type B
1 0 0 0 1 = Thermocouple Type N
1 0 0 1 0 = RTD 100 Ω 385*
1 0 0 1 1 = RTD 200 Ω Pt 385*
1 0 1 0 0 = RTD 500 Ω Pt 385*
1 0 1 0 1 = RTD 1000 Ω Pt 385*
1 0 1 1 0 = RTD 100 Ω Pt 3916*
1 0 1 1 1 = RTD 200 Ω Pt 3916*
1 1 0 0 0 = RTD 500 Ω Pt 3916*
1 1 0 0 1 = RTD 1000 Ω Pt 3916*
1 1 0 1 0 = RTD 10 Ω Cu 426*
1 1 0 1 1 = RTD 120 Ω Ni 618*
1 1 1 0 0 = RTD 120 Ω Ni 672*
1 1 1 0 1 = Resistance 3000 Ω*
1 1 1 1 0 = Thermocouple Type C
1 1 1 1 1 = CJC
* = Valid for channels 4-7 only.
** = For these input ranges, the open circuit response does not apply and should be disabled.

1746sc-CTR4 / 1746sc-CTR8

1. Determine the backplane power requirements.
Use the table below to calculate the total load on the system power supply. For more information, see the Allen-Bradley system Installation and Operation Manual.

	Backplane Current Consumed	
	5VDC	24VDC
CTR4	175mA	75mA
CTR8	225mA	125mA

2. Wire your module.

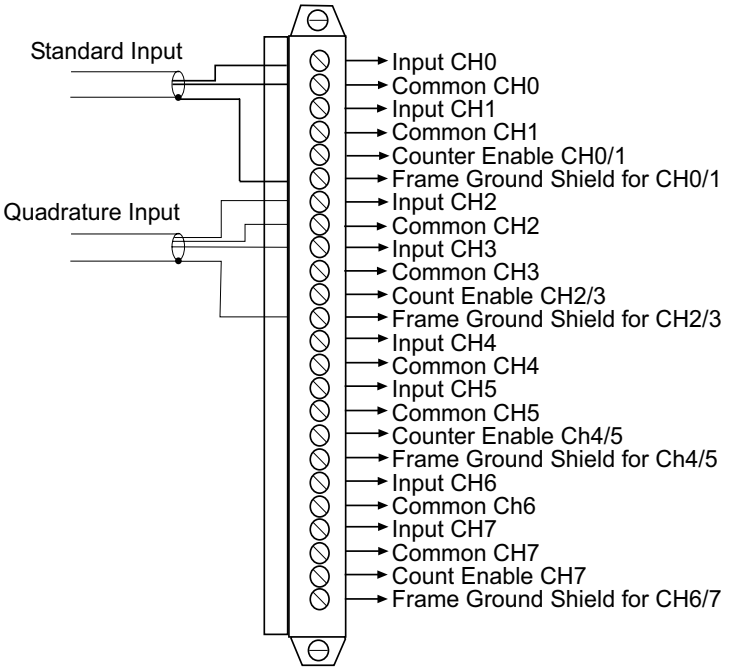
To wire your module, you need:
- a small, flat-blade screwdriver
- Belden 8761 (shielded, twisted pair) cable or equivalent

You do not need to remove the supplied 16-position terminal block from the module. If however, you do remove the terminal block, apply the supplied write-on label to the terminal block, and use the write-on label to identify your module's location.

Before wiring the terminal block, unscrew the two retaining screws at the top and bottom of the terminal block, and carefully pry the terminal block loose.

Before wiring the terminal block, take some time to plan your system:
- Ensure that the SLC 500 system is properly grounded and installed in a NEMA-rated enclosure.
- Route the field wiring away from other wiring and as far as possible from sources of electrical noise, such as motors, transformers, contactors, and AC devices.
- Route the field wiring in grounded conduit if possible.
- Ensure that the field wiring crosses AC or power cables at a right angle.

Terminal Block Pinouts



Note: Channels 4-7 are only available on the 1746sc-CTR8 module.

3. Assign your module to a slot.
When assigning your module to a slot, select the module from the displayed list. If your module is not listed, select OTHER at the bottom of the list and enter your module's ID code at the prompt.

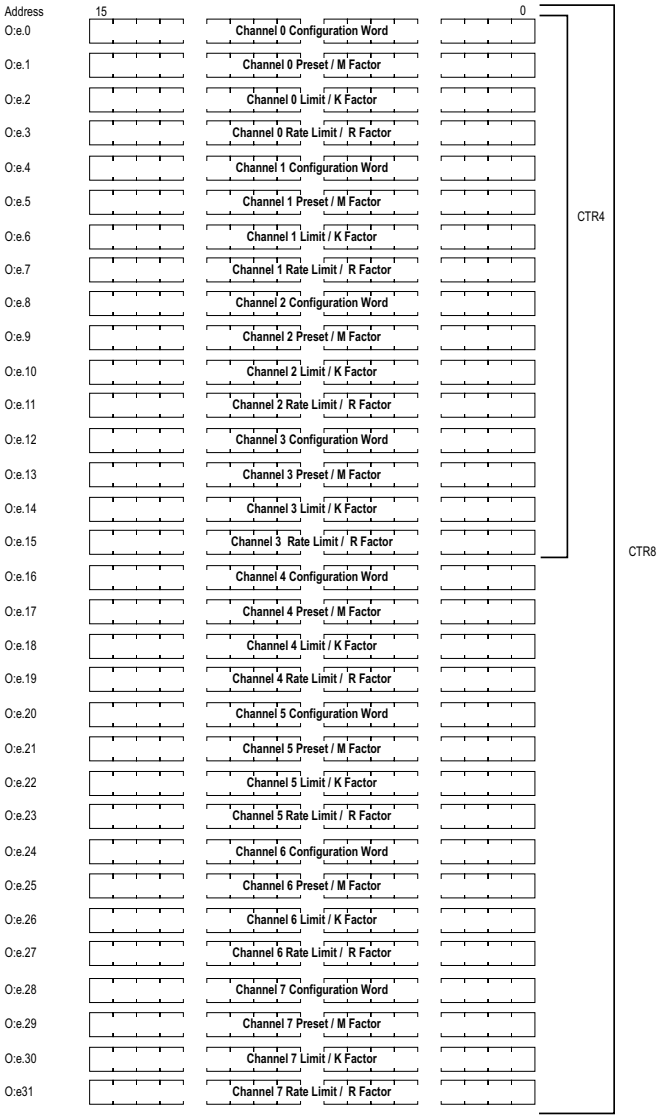
Catalog Number	Module ID Code
1746sc-CTR4	10200
1746sc-CTR-8	10401

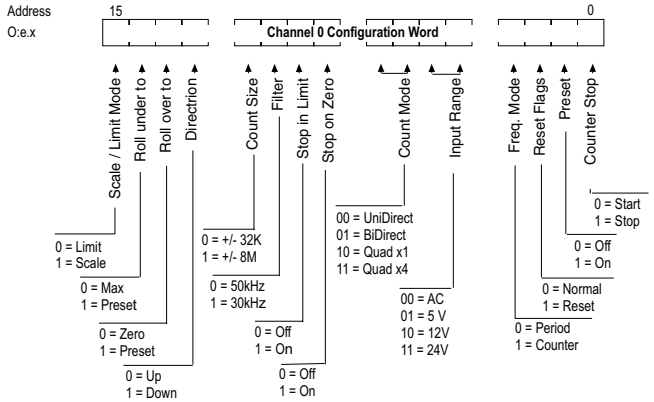
Note: The counter module supports Class III backplane communication. This module will not work with the SCL5/01 processor. Please refer to your users manual for additional information regarding ladder programming and module configuration.

4. Set jumpers
Removing the onboard jumper JP2 activates the 15 KHz hardware input filter for channels 0-3. Removing the onboard jumper JP3 activates the 15 KHz hardware input filter for channels 4-7 (CTR8 only). You may also select from two digital filters. Refer to your operations manual for additional information.

5. Configure each channel

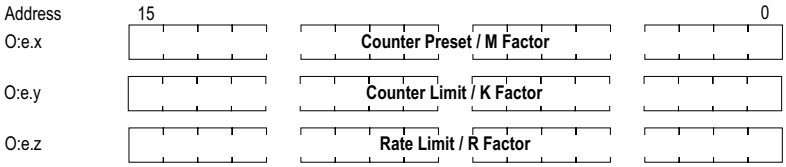
The input configuration word detailed below shows the configuration setup for a given channel. Each channel has 4 associated words. Note the appropriate word address before performing configuration.





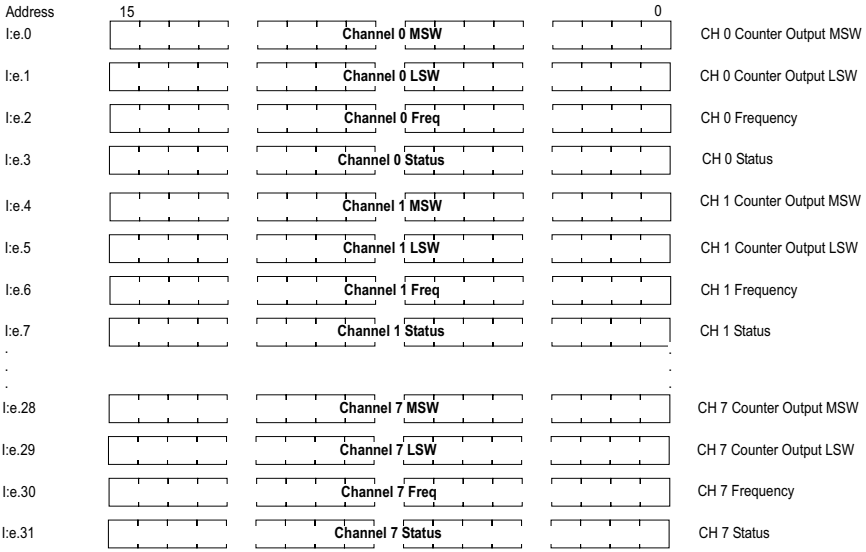
6. Set limits, scale if applicable.

A counter preset may be input to define the counter start point. The limit field may be used to flag a high or low point in the count cycle. The frequency limit may be used to flag a particular frequency value and toggle a status bit. The scale factor may be used to convert frequency data into Engineering Units. The scale and preset/limit configuration bits must be set before the values are stored. Refer to your user manual for more information about these functions.

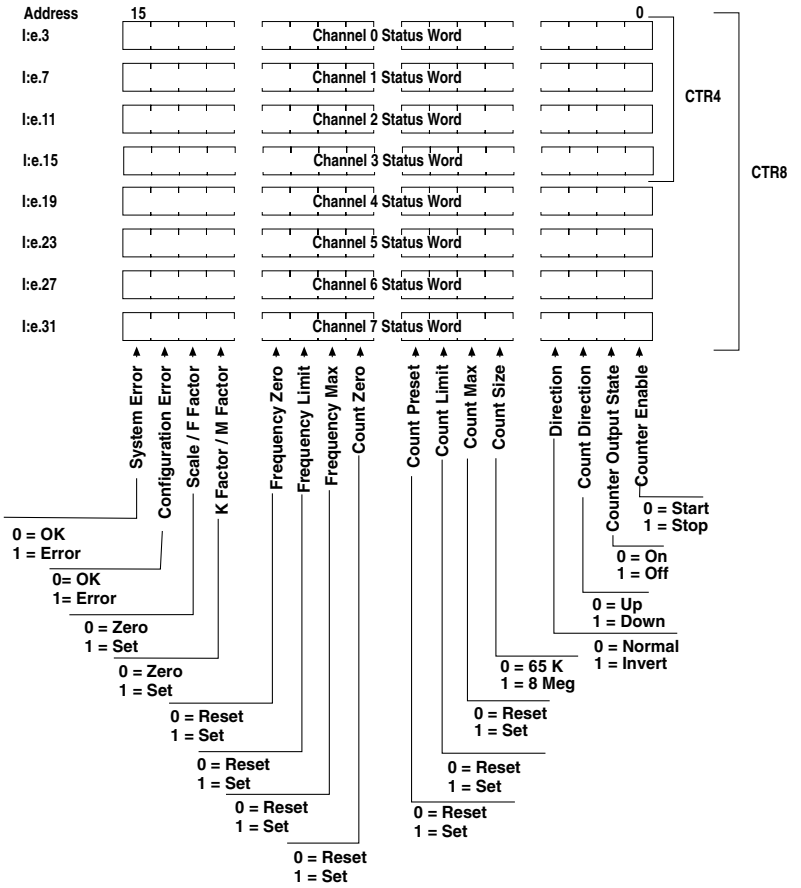


7. Monitor each channel's data.

Each channel has 3 associated data words and 1 status word. Counter data is provided in two forms, count and rate. The count data is the combintation of word 1 (MSW) and 2 (LSW). Frequency data is word 3. When the Instant/Average configuration bit is set to 0 the rate data is based on a single count trigger. When set in Average mode the rate value is a 1 second average of count data.



8. Check each channel's configuration and status.
The status word is shown below.



1746sc-NO8i & 1746sc-NO8v

The module will operate in Class 1 or Class 3 mode. This section describes how to configure the module for Class 1 operation. Class 1 provides basic data output with no user scaling. No configuration is required. This mode is compatible with the 1746-NO4 module.

Class 3 allows you to select units, ramping, clamping limit, alarming, safe state options and alarm latching. For more information regarding these features refer to the operators manual which may be found on our web site, www.spectrumcontrols.com.

1. Backplane power requirements
Use the table below to calculate the total load on the system power supply. For more information, see the Allen-Bradley system Installation and Operation Manual.

Catalog Number	5 Vdc	24V w/o ext. supply	w/ ext. supply*
1746sc-NO8i	120mA	250 mA	0 mA
1746sc-NO8v	120 mA	160 mA	0 mA

* The 1746sc-NO8i and 1746sc-NO8v output modules can be connected to an external 24 Vdc power supply to reduce backplane loading.

2. Set the module's external power jumper JP4
The jumper, JP4, is located in the bottom corner of the module's large circuit board near the power supply.

⚠ WARNING: Module is ESD sensitive. Handle accordingly.

NOTE: When using the External Power Feature, the external power and SLC power must be turned on simultaneously.

- With the jumper in the 1-2 position, the module draws all its power from the backplane of the SLC system.

- With the jumper in the 2-3 position, the module draws its 24 Vdc power from an external power source; however, the module still draws its 5 Vdc power from the backplane.

3. Wire your module

To wire your module, you need:

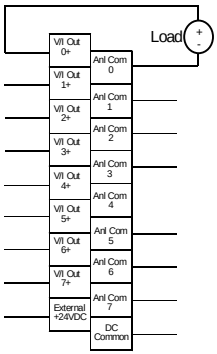
- a small, phillips-blade screwdriver
- Belden 8761 (shielded, twisted pair) cable or equivalent

You do not need to remove the supplied 18-position terminal block from the module. If however, you do remove the terminal block, use the write-on label to identify your module's location. Before wiring the terminal block, turn off the power, unscrew the two retaining screws at the top and bottom of the terminal block, and carefully pry the terminal block loose.

Before removing the terminal block, take some time to plan your system:

- Ensure that the SLC 500 system is properly grounded and installed in a NEMA-rated enclosure.
- Turn off the power.
- Route the field wiring away from other wiring and as far as possible from sources of electrical noise, such as motors, transformers, contactors, and AC devices.
- Route the field wiring in grounded conduit if possible.
- Ensure that the field wiring crosses AC or power cables at a right angle.

For CE compliance, Ferrite EMI Suppressors are needed on each channel's terminal block connection. Apply the suppressor close to the module terminal block. A Steward Part 2882024-0A0 or equivalent is recommended.



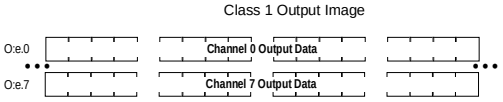
4. Assign your module to a slot

When assigning your module to a slot, select the module from the displayed list. If your module is not listed, select OTHER at the bottom of the list and enter your module's ID code at the prompt.

Catalog Number	Module ID Code	
	Class 1	Class 3
1746sc-NO8i	3527	12727
1746sc-NO8v	3528	12728

5. Control each channel's signal level

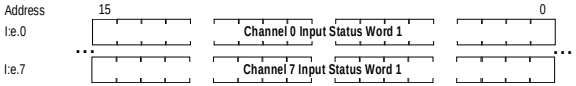
Use Output Words 0-7 (address O:e.0 – O:e.7) to control the output signal level of each channel. The output signal level is fixed for Class 1 mode and identical to that of the 1746-NO4 module.



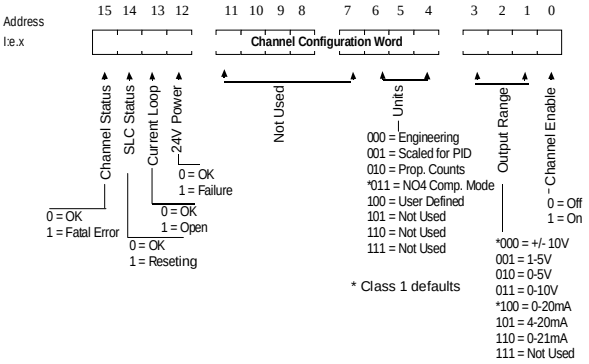
For 1746sc-NO8v: -10V to +10V = -32,768 to 32764
For 1746sc-NO8i: 0mA to 21mA = -32,768 to 32764
Refer to the operators manual for Class 3 range information.

6. Check each channel's configuration and status

Use Input Words 0-7 (addresses I:e.0 – I:e.7) to check the configuration and status of each channel. When a channel is disabled, its status word is set to 0.



Bit settings in the status word



Visit our Web Site or ask your distributor about these other Allen-Bradley compatible products from Spectrum Controls:

Catalog No.	Description
1746sc-NO8i	Analog Outputs (8) Current only
1746sc-NO8v	Analog Outputs (8) Voltage only
1746sc-CTR4	(4) General Purpose 50kHz Counter or Turbine Flowmeter
1746sc-CTR8	(8) General Purpose 50kHz Counter or Turbine Flowmeter
1746sc-NI8u	Universal Analog Inputs (8)
1746sc-INI4vi	Isolated-Channel Analog Inputs (4) Each Current or Voltage Selectable
1746sc-INI4i	Isolated-Channel Analog Inputs (4) Current only
1746sc-INO4vi	Isolated-Channel Analog Outputs (4) Each Current or Voltage Selectable
1746sc-INO4i	Isolated-Channel Analog Outputs (4) Current only
1746sc-IA8I	Isolated-Circuit 100/120 Vac/dc Inputs (8)
1746sc-IB8I	Isolated-Circuit 24 Vdc Inputs (8)
1746sc-IC8I	Isolated-Circuit 48 Vdc Inputs (8)
1746sc-IM8I	Isolated-Circuit 200/240 V ac/dc Inputs (8)
1746sc-OAP8I	Isolated-Circuit 120/240 Vac Outputs (8)
1771sc-IMI16	Isolated-Circuit 200/240 Vac/dc Inputs (16)
1771sc-OMI16	Isolated-Circuit 120/240 Vac Triac Outputs (16) Each Fuse Protected
1771sc-IFE32	(32) Single-ended Analog Inputs or (16) Differential, Current or Voltage

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